

## U.S. FISH AND WILDLIFE SERVICE - SPOTLIGHT SPECIES ACTION PLAN

**Common Name:** Kittlitz's murrelet

**Scientific Name:** *Brachyramphus brevirostris*

**Lead Region:** 7

**Lead Field Office:** Anchorage Fish and Wildlife Field Office

### **Species Information:**

**Status:** Candidate

**Recovery Priority Number or Listing Priority Number:** LPN = 2

**Recovery Plan or Candidate Assessment Form:** Candidate Assessment Form, approved October 2009 (available at [http://ecos.fws.gov/docs/candforms\\_pdf/r7/B0AP\\_V01.pdf](http://ecos.fws.gov/docs/candforms_pdf/r7/B0AP_V01.pdf))

**Most Recent 5-year Review:** None

**Other:** Candidate status designated May 4, 2004 (69 FR 24876). The International Union for Conservation of Nature and Natural Resources (IUCN) considers Kittlitz's murrelets critically endangered. NatureServe categorizes Kittlitz's murrelets as Globally Imperiled (G2; NatureServe 2005).

**Threats:** Potential threats to Kittlitz's murrelets include climate change and deglaciation, mercury and petroleum contamination, disturbance by tour boat traffic, bycatch in commercial gillnet fisheries, avian predation, and low recruitment. Marine regime shifts and glacial retreat may be changing forage fish availability. We further discuss potential threats in Appendix A.

**Target:** Evaluate past, current, and future research on Kittlitz's murrelets to identify data gaps and set priorities for subsequent research. Refine and coordinate techniques to improve monitoring and research efforts, including development and implementation of robust, frequent, and standardized survey methods across the range of Kittlitz's murrelets that can be extrapolated to population estimates (Lindell 2005, M. Kirchhoff, Audubon Alaska, Director of Bird Conservation, Anchorage, *personal communication*). These targets are necessary for further conservation of Kittlitz's murrelets. They will also help us determine the causes for Kittlitz's murrelet population declines and quantify impacts of potential threats.

The Kittlitz's murrelet is currently undergoing dramatic declines throughout its North American range (Appendix A). The species occurs primarily in four regions of Alaska: 1) Southeast Alaska (45%), 2) Southcentral Alaska (23%), 3) the Aleutian Islands (18%), and 4) the Alaska Peninsula (14%) (USFWS 2009). Because the causes for these dramatic declines are unknown, it is not possible to achieve recovery or prevent decline of this species over the next 5 years. For this reason, it is also premature to prioritize conservation actions, decide how to direct funds, or ascertain the appropriate roles of various agencies at this time.

**Measure:** Plan and host meetings of the Kittlitz's Murrelet Technical Committee (comprised of Federal, State, and university biologists and researchers) to identify and prioritize data gaps, research, and conservation needs for Kittlitz's murrelet, and coordinate Kittlitz's murrelet research to facilitate data interpretation across the range of Kittlitz's murrelets and improve efficiency of collecting population status and reproductive performance information. A goal of these meetings will be to prioritize research to address the following questions: 1) where Kittlitz's murrelets go in winter; 2) what are the migratory or dispersal paths between breeding and wintering grounds; 3) what areas do Kittlitz's murrelets use that are currently not being studied; and 4) how can we refine range-wide techniques for estimates of population size and reproductive performance for the species (with a subsequent pilot study evaluating these techniques)? Kissling (2009) compiled a list of all funded Kittlitz's murrelet research to help generate a list of recovery tasks and associated budget information for future Kittlitz's murrelet actions.

**Actions:** Increasing recruitment and sizes of Kittlitz's murrelet populations cannot be achieved until we expand research efforts to understand the causes of the current low levels and quantify the various threats. At this time, we will focus our efforts in the following several areas to aid conservation of Kittlitz's murrelets:

- Reduce oil pollution and the risk of catastrophic spills through oil spill contingency planning.
- Encourage efforts to identify and reduce oil spills associated with the thousands of vessels that travel along the Aleutian Islands to reduce the threat of large ships going aground and breaking up during severe weather.
- Stage emergency response vessels and/or support other mechanisms (e.g., emergency towing systems, enhanced local response capability) to help alleviate this threat.
- Reduce disturbance to Kittlitz's murrelets through cooperation with the land management entities where murrelets occur (most notably within National and State Parks and National and State Wildlife Refuges along the coast of the Gulf of Alaska).
- Determine areas of spatial overlap between Kittlitz's murrelet habitat and higher-risk fishing activities, such as nearshore gillnetting, to target areas for possible fishing restrictions or modifications to gear or fishing techniques. Monitor bird bycatch by commercial fishing, conduct additional research into effective deterrent devices, and target outreach efforts to gillnetters.
- Other research needs include investigating the following factors and their related impacts on Kittlitz's murrelet populations: climate change, including glacial retreat and the extent to which melting glaciers deposit contaminants, especially mercury, into the marine ecosystem; the distribution and abundance of prey species; changes in foraging, breeding, and wintering habitats; and the influences of human activities on predator species, such as peregrine falcon and bald eagle.

### **Identify responsible parties for the actions:**

- Oil spill contingency planning, reducing the threat of oil spills, and evaluating the effects of oil spills [Joint Federal/ State/ Industry/ Local communities/ NGOs (Non-Governmental Organizations)].
- Effects of human activities, including vessel disturbance [Federal].
- Reduce bycatch of Kittlitz's murrelets [Joint State/ Federal/ Industry, involving Alaska Sea Grant].
- Research [State and Federal].
  - Health assessment of Kittlitz's murrelets in key population areas: Kachemak Bay, Prince William Sound, Glacier Bay, southern Kenai Peninsula, Icy Bay, Malaspina Forelands, Kodiak Island, and the Aleutians.
  - Use fall to spring pelagic surveys (on vessels of opportunity) to assess non-breeding habitat needs.
- Climate change investigations relative to effects that declining ice has upon food webs of Kittlitz's murrelets [Federal].
- Climate change outreach education [United States Fish and Wildlife Service and NGOs (Non-Governmental Organizations)].
- Effects of predation on populations of Kittlitz's murrelets [Federal, State]

*Estimated costs of these actions:* \$3 million

### **Role of other agencies:**

The Kittlitz's murrelet is federally protected under the Migratory Bird Treaty Act. Under the Endangered Species Act, it is a candidate species.

### **State of Alaska**

The State of Alaska has, along with many other entities, been invited to participate on the Kittlitz's Murrelet Technical Committee. At this time, we offer the following suggestions where coordinating efforts would facilitate greater conservation of Kittlitz's murrelets, especially in the State's jurisdictional marine waters (from 0-3 miles from shore):

- Population abundance and trend monitoring of Kittlitz's murrelet populations, including documenting winter distribution, seasonal movements, and migratory pathways.

- Conducting research related to unsustainably low recruitment rates of Kittlitz's murrelets on State lands.
- Developing guidelines for tour boats and recreational boaters to minimize disturbance of murrelets and regulate vessel traffic in certain waters heavily used by Kittlitz's murrelets.
- Developing methods to discourage or reduce predation of murrelets by avian predators, especially in areas where anthropogenic factors have concentrated avian predators.
- Collaborating to increase the monitoring rate of State-managed commercial gillnet fisheries in areas used by Kittlitz's murrelets to quantify and, if warranted, reduce bycatch of Kittlitz's murrelets. Collaborating on research of fishing gear and techniques to reduce bycatch and facilitate implementation of effective gear and/or techniques.

#### National Marine Fisheries Service

Although we are uncertain where Kittlitz's murrelets go in the winter, it is probable they occupy marine waters more than 3 miles from shore. Bycatch observers supervised by National Marine Fisheries Service (NMFS) should be trained to identify Kittlitz's murrelets and document observations at sea.

#### National Park Service

Because nearly half of the at-sea population during the breeding season is on or adjacent to National Park Service (NPS) lands (M. Kissling, U.S. Fish and Wildlife Service, Juneau, *personal communication*), the NPS plays an important role in coordinating nesting studies on NPS lands and in studying Kittlitz's murrelets at sea along the shores of National Parks.

#### U.S. Forest Service

The U. S. Forest Service (USFS) has some control of recreational use in areas such as Prince William Sound that are important for Kittlitz's murrelets. We should share information regarding Kittlitz's murrelets in areas of recreational use under their jurisdiction and analyze whether there are detrimental impacts that arise from recreational use of USFS lands.

**Role of other Endangered Species Act programs:** Three FWS field offices will: participate in research related to unsustainably low recruitment rates of Kittlitz's murrelets; help develop methods to discourage predation of Kittlitz's murrelets by falcons and eagles; and encourage additional monitoring and enforcement of fisheries that may take Kittlitz's murrelets. Other tasks, listed by field office, include:

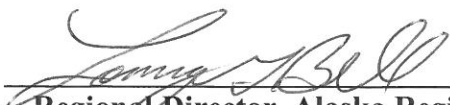
- Anchorage Fish and Wildlife Field Office: Continue collaborative work with the U.S. Geological Service and National Wildlife Refuges to investigate declining population trends of Kittlitz's murrelets. Continue collaborative work with the Department of the Interior and U.S. Coast Guard regarding oil spill contingency planning.

- Fairbanks Fish and Wildlife Field Office: Investigate the Norton Sound and Cape Lisburne nesting population of Kittlitz's murrelets and use of coastal waters of the Chukchi Sea.
- Juneau Fish and Wildlife Field Office: Work with other Federal agencies to reduce recreation and tour boat disturbance in areas that are heavily used by Kittlitz's murrelets, as well as continue involvement with nesting population research.

**Role of other U.S. Fish and Wildlife programs**: Three non-endangered species programs will help implement this action plan for Kittlitz's murrelets.

- Migratory Bird Management Program: Coordinate population abundance and trend monitoring efforts of Kittlitz's murrelets. Provide for research of bird bycatch avoidance gear and techniques for gillnet fisheries. Develop methods to discourage predation of Kittlitz's murrelets by falcons and eagles, especially in areas where they are concentrated by anthropogenic factors.
- Refuges Program: Work with the United States Coast Guard to minimize risks associated with Trans-Pacific vessel traffic through passes in the Aleutian Islands and to station emergency assistance vessels at strategic locations to prevent vessel groundings, especially within the National Wildlife Refuge system. Continue collaboration with the United States Geological Survey to investigate population trends, breeding ecology, and recruitment of Kittlitz's murrelets at the Alaska Maritime and Kodiak National Wildlife Refuges.
- Law enforcement: Increase enforcement of the Migratory Bird Treaty Act within 12 nautical miles of shore, especially in areas where Kittlitz's murrelets have been taken in gill nets.

**Additional funding analysis**: At this time, we have little funding to carry out the recovery tasks outlined in this spotlight species action plan. We have coordinated with partners and leveraged funding to conduct initial research studies on this species. Additional funds would enable us to work with other agencies and organizations to expand our research efforts, as outlined above. In addition, we will continue to pursue funding from our Washington Office to prepare a listing proposal for this species.

Approved:   
 Acting Regional Director, Alaska Region  
 U.S. Fish and Wildlife Service

Date: 09 April 2010

## Appendix A – Population Trend and Threat Assessment

### Population Trend

Throughout Alaska, Kittlitz's murrelet populations declined as much as 18% annually during 1989-2000 (Kuletz *et al.* 2003b, McKnight *et al.* 2003, U.S. Fish and Wildlife Service 2004). In Prince William Sound, Kittlitz's murrelet populations have declined by as much as 84% since 1989 and extirpation is predicted there by 2035 (Kuletz *et al.* 2005). Along the coast of the Kenai Fjords, Kittlitz's murrelet populations declined 74% between 1986 and 2002 (Van Pelt and Piatt 2003). In Lower Cook Inlet, Kittlitz's murrelet populations declined 13% per year from 1984 to 2004 (Speckman *et al.* 2005). In Kachemak Bay, Kittlitz's murrelet densities declined 43% between the decadal periods of 1988-1999 and 2004-2007 (Kuletz *et al.* 2008). Kittlitz's murrelet populations in the Malaspina Forelands declined as much as 75% during 1992-2002 (Kissling *et al.* 2005) and 53% in Icy Bay during 2002-2007 (M. Kissling, *unpublished data*, 2007). In Glacier Bay, Kittlitz's murrelet populations declined 80% from 1991-2000 (Robards *et al.* 2003). In contrast, M. Kirchhoff (Audubon Alaska, Director of Bird Conservation, Anchorage, *unpubl. data*) reported comparable population densities for Kittlitz's murrelets in Glacier Bay of 2.07 birds per sq. km. in 1993 and 3.45 per sq. km. in 2009.

We need to develop survey techniques that provide robust population estimates across the range of Kittlitz's murrelets. Once we have refined techniques and have used them to acquire range-wide population estimates, we can further investigate the following list of possible factors that may be contributing to the decline of Kittlitz's murrelet populations.

### Threat Assessment

*Climate change and deglaciation:* This species is closely associated with tidewater glaciers and glacial outwash. During the past 50 years, glaciers have been melting at rates that cannot be explained by recent historical trends (Brown *et al.* 1982, Dyurgerov and Meier 2000), likely due to increases in temperature caused by increased concentration of greenhouse gasses in the atmosphere (Crowley 2000, IPCC 2001, Karl and Trenberth 2003, Stott 2003, IPCC 2007).

Kittlitz's murrelets exhibit a strong association to glacially-influenced marine habitats (Kendall and Agler 1998, Kuletz *et al.* 2003a, Robards *et al.* 2003, Van Pelt and Piatt 2003, Van Pelt and Piatt 2005, Agness 2006). Their preference for areas near stable or advancing tidewater glaciers may be related to the diversity and abundance of high energy forage fishes, such as Pacific capelin (*Mallotus villosus*) and Pacific sand lance (*Ammodytes hexapterus*) (Piatt *et al.* 1994, Day *et al.* 2000, Agness 2006, Kissling, *unpublished data*, 2007, Piatt, *unpublished data*, 2008). The distribution and availability of these high energy forage fishes may change as glaciers recede and the physical parameters of marine habitats are modified. In turn, reduced diversity and abundance of high energy forage fishes may reduce the ability of Kittlitz's murrelets to feed young during nesting season and further lower survivorship and recruitment.

In other seabirds, low breeding success is usually related to low food or low quality prey; we hypothesize that reduced availability or quality of prey is contributing to Kittlitz's murrelet decline. Marbled murrelets (*Brachyramphus marmoratus*) use high quality prey for their chicks (Kuletz 2005) and the lack of high quality prey in California was linked to population declines of

marbled murrelets there (Becker and Beissinger 2006). In addition, lack of high quality prey was correlated with slow growth rates and low survivorship of Kittlitz's murrelet chicks at Agattu Island (Kaler, *unpublished data*). The availability of high quality prey could be impacted by myriad factors, including climate change and/or other anthropogenic ecosystem disruptions, as well as decadal oceanic oscillation / regime shifts / acidification.

*Petroleum contamination:* Kittlitz's murrelets are vulnerable to direct mortality from oil pollution (King and Sanger 1979). Over 2,700 ship voyages occur through the Aleutians each year adjacent to Kittlitz's murrelet habitat and are made by vessels that have no State oil spill contingency plans and no State certificate of financial responsibility (NRPGCII 2005). This vessel traffic includes as many as 1,600 voyages by container ships with a typical fuel capacity of 1.8 million gallons of persistent oil, and as many as 30-40 voyages by tank ships that may carry as much as 800 million gallons of oil as cargo and fuel (NRPGCII 2005). Between 1990 and 2005, 415 U.S. vessel casualties were reported, in addition to at least 45 foreign vessel casualties (NRPGCII 2005). Sixteen-percent of Kittlitz's murrelets in Alaska nest on the Aleutian Islands of the Alaska Maritime National Wildlife Refuge adjacent to the great circle shipping route (M. Kissling, U.S. Fish and Wildlife Service, Juneau, *personal communication*). The shortest distance between East Asia and the Canadian-American Pacific Northwest runs through the Bering Sea. As a result, vessels traveling the great circle shipping route between East Asia and the North American West Coast actually pass both north and south of the Aleutian Islands (see Figure 1).



Figure 1. The great circle shipping route between East Asia and the Canadian-American Pacific Northwest (Courtesy of [http://benmuse.typepad.com/ben\\_muse/2007/01/the\\_great\\_circl.html](http://benmuse.typepad.com/ben_muse/2007/01/the_great_circl.html)).

From 1995 through August 2005, at least 1,923 small fuel spills from vessels resulted in the release of more than 271,700 gallons of petroleum hydrocarbons in Alaska waters (Alaska Department of Environmental Conservation, Anchorage, *unpublished data*, 2005). Ninety

percent of those spills occurred in marine habitat within the range of Kittlitz's murrelets (U.S. Fish and Wildlife Service, *unpublished data*). Small oil spills have put specific populations of Kittlitz's murrelet at risk. One example is the 2001 Windy Bay spill in Prince William Sound that released 35,000 gallons of diesel fuel (Kuletz 2001).

Though less common, large oil spills directly impact this species both immediately and over an indefinite period of time. The *Exxon Valdez* spill in March 1989 released nearly 11 million gallons of heavy Alaska crude oil into Prince William Sound, killing an estimated 500 (Kuletz 1996) to more than 1,000 Kittlitz's murrelets (van Vleit and McAllister 1994). These immediate mortality estimates represented as high as 15% of the local population, a proportion that exceeded all other species impacted by this spill. To this day, Kittlitz's murrelets and their prey species may continue to be detrimentally affected by chronic hydrocarbon contamination from residual oil in Prince William Sound.

Another large spill occurred in December 2004 when the *Selandang Ayu* spilled 354,218 gallons of bunker C and diesel fuel into the nearshore waters of Unalaska, Aleutian Islands, fouling 35 km of shoreline (Alaska Department of Environmental Conservation, Anchorage, *unpublished data*, 2005). Few murrelet carcasses were recovered immediately after the oil spill, probably because of the time of year (U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, *unpublished data*). About one-third of all the Kittlitz's murrelets around Unalaska occupied waters that were heavily oiled from this spill (Romano and Piatt, U.S. Geological Service, Anchorage, *unpublished data*) and murrelets were observed in oiled waters (Kuletz 2001, Stehn, U.S. Geological Service, Anchorage, *unpublished data*, 2005).

*Disturbance by tour boat traffic:* Although this small cryptic seabird is rarely sought out by tour boats and recreational boaters, its preferred tidewater glacier habitat is a target destination for these boaters (Day *et al.* 1999, Murphy *et al.* 2004). Such vessel activity is increasing in the glaciated fjords of Glacier Bay, Prince William Sound, Kenai Fjords, Yakutat Bay, and lower Cook Inlet/Kachemak Bay, Alaska (Murphy *et al.* 2004, Jansen *et al.* 2006, Glacier Bay National Park, *unpublished data*). Furthermore, recreational boating in northern Prince William Sound is projected to increase dramatically over the next 15 years as a result of better access to harbors (Murphy *et al.* 2004). This increased traffic increases the risk of oil contamination and increases the level of disturbance in favored foraging habitats. Such disturbance precludes feeding and increases flushing and diving behaviors. As a result, energetic demands may be increased, as well as predator exposure. Speckman *et al.* (2004) reported that boat disturbance could result in a decrease in food delivery to chicks by adults that forage or nest near busy boating areas.

*Bycatch in commercial gillnet fisheries:* We collectively refer to drift netting and set netting as gillnet fisheries. Kittlitz's murrelets have been caught in commercial gillnet fisheries in Prince William Sound (Wynne *et al.* 1991, 1992; Agler *et al.* 1998; Day and Nigro 1999). Kittlitz's murrelets have also been reported as taken in commercial fisheries off Kodiak Island and Yakutat Bay (K. Kuletz, U.S. Fish and Wildlife Service, Anchorage, *personal communication*). In Kodiak, the estimated bycatch for Kittlitz's murrelets was 18 (16 S.E.) birds per year (Manly 2007). At least one Kittlitz's murrelet was taken during the Yakutat study in 2008, but the annual bycatch estimate is not yet available. Melvin *et al.* (1999) described gear types and fishing methods that reduce such bycatch, but regulations requiring the use of bycatch reduction techniques in gillnet fisheries are currently not in place in Alaska. Manly (2003) reported that a minimum of 5-7% observer coverage was necessary to obtain a reliable estimate

of bycatch for common species; Kittlitz's murrelet is a rare species and probably requires greater coverage (K. Kuletz, U.S. Fish and Wildlife Service, Anchorage, *personal communication*). Caution should be used in extrapolating bycatch results from small samples of the gillnet fishery.

Avian predation: Peregrine falcons (*Falco peregrinus*) have often been observed perching on vessel superstructures in Glacier Bay and elsewhere. They apparently use the vessels as a watch-post, awaiting murrelets (*Brachyramphus* spp.) and other birds that flush from the water in response to vessel disturbance. The vessel watch-posts provide a means for prolonged hunts over open water that is otherwise too far from their usual perch sites (K. Kuletz, U.S. Fish and Wildlife Service, Anchorage, *personal communication*). Human activities can enhance bald eagle (*Haliaeetus leucocephalus*) populations by providing reliable sources of food via landfills and shore-based seafood processors, e.g. near Yakutat and Icy Bay (M. Kissling, U.S. Fish and Wildlife Service, Juneau, *personal communication*). In Icy Bay during summers of 2006-2008, avian predators, including bald eagles, killed 12 of 94 (13%), radio-tagged, Kittlitz's murrelets (M. Kissling, U.S. Fish and Wildlife Service, Juneau, *personal communication*). Peregrine falcons were responsible for 80% of known deaths; of 26 Kittlitz's murrelet remains found beneath eyries and plucking posts, only one included a radio-tag, suggesting that peregrine falcons were not biasing their predation towards radio-tagged individuals (M. Kissling, U.S. Fish and Wildlife Service Juneau, *personal communication*). Populations of peregrine falcons and bald eagles have increased throughout Alaska in recent decades via higher rates of productivity, survivorship, and immigration (Ritchie and Ambrose 1996, Jacobson and Hodges 1999, Ambrose *et al.* 2000, Zwiefelhofer 2007, Anthony *et al.* 2008). In addition, gulls (*Larus* spp.), ravens (*Corvus* spp.), and jaegers (*Stercorarius* spp.) may take Kittlitz's murrelet chicks from the nest (R. Kaler, graduate student, Kansas State University, *personal communication*). Photography tourism may have also spawned artificially enhanced aggregations of bald eagles. The above human activities that facilitate murrelet predation may need to be modified if local Kittlitz's murrelet populations are being detrimentally affected by this predation.

Low recruitment: Many researchers have reported low juvenile recruitment rates; protection may be necessary to bolster the species' ability to survive and recover (Day and Nigro 1999, M. Romano (U.S. Geological Service, Anchorage, *personal communication*), and M. Kissling (U.S. Fish and Wildlife Service, Juneau, *personal communication*)). The paucity of juvenile sightings nearshore may be because juveniles are difficult to identify, occur at low densities, immediately depart protected waters adjacent to nesting areas, or synchronize their dispersion from brood-rearing areas undetected (K. Kuletz, U.S. Fish and Wildlife Service, Anchorage, *personal communication*). Densities of adults and juveniles were low between 2004 and 2007 in Kachemak Bay, but the Juvenile:Adult ratios were relatively high there when compared to marbled murrelets, or compared to Kittlitz's murrelets in Prince William Sound and Icy Bay.

Low fledging success at nest sites recently reported by Burkett and Piatt (2008) is consistent with low recruitment rates. In addition, research in 2009 from two islands documented low nest success. On Kodiak Island, only one bird fledged from a total of 13 nests. Known factors of failed nests were fox depredation and abandonment (Painter 2009). Kaler *et al.* (2009) reported the primary cause of nest failure in 2006 at Agattu Island was chicks dying in the nest scrape due to exposure or starvation. Data from 2009 on Agattu Island were consistent with patterns observed in 2006 and 2008: high nest failure due to chick mortality in the nest and low fledgling mass (R. Kaler, graduate student, Kansas State University, *personal communication*). Kodiak

and Agattu Islands could be used as reference sites for health assessment of core population areas (V. Byrd, Alaska Maritime National Wildlife Refuge, Homer, *personal communication*). Bioaccumulation of mercury increases east to west in the Aleutians and has been documented in glaucous-winged gulls (*Larus glaucescens*) and bald eagles in the Aleutians (R. Kaler, graduate student, Kansas State University, *personal communication*). Mercury contamination might explain low growth rates and fledging masses of Kittlitz's murrelet chicks, as well as the high rates of chick mortality, observed on Agattu Island (R. Kaler, graduate student, Kansas State University, *personal communication*).

## Appendix B

### Literature Cited

- Agler BA, SJ Kendall, and DB Irons. 1998. Abundance and distribution of marbled and Kittlitz's murrelets in southcentral and southeast Alaska. *Condor* 100: 254-265.
- Agness AM. 2006. Effects and impacts of vessel activity on the Kittlitz's murrelet (*Brachyramphus brevirostris*) in Glacier Bay, Alaska. University of Washington. M.S. thesis. 51 pp.
- Ambrose RE, A Matz, T Swem, and P Bente. 2000. Environmental contaminants in American and Arctic peregrine falcon eggs in Alaska, 1979-1995. Technical report NAES-TR-00-02. United States Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks, Alaska.
- Anthony RG, JA Estes, MA Ricca, AK Miles, and ED Forsman. 2008. Bald eagles and sea otters in the Aleutian Archipelago: Indirect effects of trophic cascades. *Ecology* 89: 2725-2735.
- Becker BH and SR Beissinger. 2006. Centennial decline in the trophic level of an endangered seabird after fisheries decline. *Conservation Biology* 20(2): 470-479.
- BirdLife International. 2005. Species factsheet: *Brachyramphus brevirostris*. Accessed August 19, 2005. <<http://www.birdlife.org>>.
- Brown CS, MF Meier, and A Post. 1982. Calving speed of Alaska tidewater glaciers, with application to Columbia Glacier. United States Geological Survey Professional Paper 1258-C. 13 pp.
- Burkett E and JF Piatt. 2008. Kittlitz's murrelet research on Kodiak National Wildlife Refuge in 2008. United States Fish and Wildlife Service Report, Kodiak National Wildlife Refuge.
- Carter HR, MLC McAllister, and MEP Isleib. 1995. Mortality of marbled murrelets in gill nets in North America. Pages 271-284 *In* Ecology and conservation of the marbled murrelet. CJ Ralph, GL Hunt, Jr., MG Raphael, and JF Piatt (eds.). United States Department of Agriculture, Forest Service General Technical Report PSW-GTR-152.
- Crowley TJ. 2000. Causes of climate change over the past 1,000 years. *Science* 289: 270-277.
- Day RH and DA Nigro. 1999. Status and ecology of Kittlitz's murrelet in Prince William Sound, 1996-1998. Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 98142). ABR, Inc., Fairbanks, Alaska.
- , -----, and AK Prichard. 2000. At-sea habitat use by the Kittlitz's murrelet *Brachyramphus brevirostris* in nearshore waters of Prince William Sound, Alaska. *Marine Ornithology* 28: 105-114.
- Dyrugerov MB and MF Meier. 2000. Twentieth century climate change: Evidence from small glaciers. *Proceedings of the National Academy of Sciences* 97: 1406-1411.

- [IPCC] Intergovernmental Panel on Climate Change. 2001. Climate change 2001: The science of climate change, contribution of working group 1 to the third assessment report of the Intergovernmental Panel on Climate Change. JT Houghton, Y Ding, DJ Griggs, M Noguer, PJ van der Linden, X Dai, K Maskell, and CA Johnson (eds.). Cambridge University Press, Cambridge, UK.
- , 2007. Climate change 2007: The physical science basis. Summary for policymakers. Contribution of working group 1 to the fourth assessment report of the Intergovernmental Panel on Climate Change. Last revised February 5, 2007; retrieved April 19, 2007. <<http://www.ipcc.ch/SPM2feb07.pdf>>.
- Jacobson MJ and JI Hodges. 1999. Population trend of adult bald eagles in southeast Alaska, 1967-1997. *Journal of Raptor Research* 33: 295-298.
- Jansen JK, JL Bengtson, PL Boveng, SP Dahle, and J Ver Hoef. 2006. Disturbance of harbor seals by cruise ships in Disenchantment Bay, Alaska: An investigation at three spatial and temporal scales. Final report. National Marine Mammal Laboratory. Seattle, Washington. 87 pp.
- Kaler RSA, LA Kenney, and BK Sandercock. 2009. Breeding ecology of Kittlitz's murrelets at Agattu Island, Aleutian Islands, Alaska. *Waterbirds* 32(3): 363-479.
- Karl TR and K Trenberth. 2003. Modern climate change. *Science* 302: 1719-1723.
- Kendall SJ and BA Agler. 1998. Distribution and abundance of Kittlitz's murrelets in southcentral and southeastern Alaska. *Colonial Waterbirds* 21(1): 53-60.
- King JG and GA Sanger. 1979. Oil vulnerability index for marine oriented birds. *In* Conservation of marine birds of northern North America. JC Bartonek and DN Nettleship (eds.). United States Fish and Wildlife Service, Wildlife Research Report 11: 1-319.
- Kissling ML, KJ Kuletz, and S Brockmann. 2005. Distribution and abundance of *Brachyramphus* murrelets from Icy Bay to Cross Sound and in selected mainland fjords of southeast Alaska. Unpublished report. United States Fish and Wildlife Service, Juneau, Alaska.
- , SM Gende, PM Lukacs, SB Lewis, and NR Hatch. 2008. Identifying nesting and foraging habitat of Kittlitz's murrelets in Icy Bay, Alaska. United States Fish and Wildlife Service Report. Juneau Field Office, Alaska.
- , 2009. Pages 15-20 *In* Meeting minutes for Kittlitz's murrelet technical committee annual meeting. Held February 22, 2009, in Hakodate, Japan in conjunction with Pacific Seabird Group annual meeting. 20 pp.
- Kuletz KJ. 2001. Marine bird and mammal surveys pre- and post-spill for areas affected by the Windy Bay Oil Spill in Prince William Sound, in summer 2001. Unpublished report. United States Fish and Wildlife Service, Anchorage, Alaska.

- , SW Stephensen, DB Irons, EA Labunski, and KM Brenneman. 2003a. Changes in distribution and abundance of Kittlitz's murrelets *Brachyramphus brevirostris* relative to glacial recession in Prince William Sound, Alaska. *Marine Ornithology* 31: 133-140.
- , EA Labunski, and KM Brenneman. 2003b. Distribution and abundance of Kittlitz's murrelets in Prince William Sound, Alaska, in summer 2001. Unpublished report. United States Fish and Wildlife Service, Anchorage, Alaska.
- , B Manly, C Nations, and DB Irons. 2005. Declines in Kittlitz's and marbled murrelets in Prince William Sound, Alaska: Dealing with uncertainty. Pages 173-195 *In* Foraging behavior and productivity of a non-colonial seabird, the marbled murrelet (*Brachyramphus marmoratus*) relative to prey and habitat. K Kuletz. Ph.D. dissertation. University of Victoria, Victoria, British Columbia.
- , EA Labunski, and SG Speckman. 2008. Abundance, distribution, and decadal trends of Kittlitz's and marbled murrelets and other marine species in Kachemak Bay, Alaska. Final Report (Project No. 14) by United States Fish and Wildlife Service for Alaska Department of Fish and Game, State Nongame Wildlife Grant, Anchorage, Alaska.
- Lindell J. 2005. Results of at-sea *Brachyramphus* murrelet surveys in Icy Strait and other selected areas of southeast Alaska 1993-1999. United States Fish and Wildlife Service, Juneau, Alaska. 83 pp.
- Manly BFJ. 2003. Incidental catch and interactions of marine mammals and birds in the Cook Inlet salmon driftnet and setnet fisheries, 1999-2000. Final report by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. National Marine Fisheries Service, Juneau, Alaska. 100 pp.
- , 2007. Incidental take and interactions of marine mammals and birds in the Kodiak Island salmon set gillnet fishery, 2002 and 2005. Final report by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. National Marine Fisheries Service, Juneau, Alaska. 221 pp.
- McKnight AE, KM Sullivan, SW Stephensen, DB Irons, KJ Kuletz, and EA Labunski. 2003. Distribution, abundance, and foraging behavior of Kittlitz's (*Brachyramphus brevirostris*) and marbled murrelets (*Brachyramphus marmoratus*) in College and Harriman fjords, Prince William Sound, Alaska, in summer 2003. Unpublished report. United States Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.
- Melvin EF, JK Parrish, and LL Conquest. 1999. Novel tools to reduce seabird bycatch in coastal gillnet fisheries. *Conservation Biology* 13(6): 1386-1397.
- Murphy KA, LH Suring, and A Iliff. 2004. Western Prince William Sound human use and wildlife disturbance model, Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 99339). United States Department of Agriculture, Forest Service, Chugach National Forest, Anchorage, Alaska.
- [NRPGCII] Nuka Research and Planning Group and Cape International, Inc. 2005. Vessel traffic in the Aleutians Subarea. Report to Alaska Department of Environmental Conservation. 56 pp.

- Painter K. 2009. Kodiak: Expedition yields a jackpot of data about secretive sea bird, the Kittlitz's murrelet. United States Fish and Wildlife Service, Kodiak National Wildlife Refuge, Alaska.
- Piatt JF, NL Naslund, and TI van Pelt. 1994. Nest-site selection and fidelity in Kittlitz's murrelet. *Beringian Seabird Bulletin* 2: 54–56.
- Ritchie RJ and S Ambrose. 1996. Distribution and population status of bald eagles (*Haliaeetus leucocephalus*) in interior Alaska. *Arctic* 49: 120-128.
- Robards M, G Drew, JF Piatt, JM Anson, A Abookire, J Bodkin, P Hooge, and S Speckman. 2003. Ecology of selected marine communities in Glacier Bay: Zooplankton, forage fish, seabirds and marine mammals. Final report to the National Park Service, United States Geological Survey, Alaska Science Center, Anchorage. 156 pp.
- Speckman SG, JF Piatt, and AM Springer. 2004. Small boats disturb fish-holding marbled murrelets. *Northwestern Naturalist* 85: 32-34.
- , -----, and KJ Kuletz. 2005. Population status and trends of *Brachyramphus* murrelets in lower Cook Inlet, Alaska. Science Support Program/ Species at Risk. Annual report for United States Fish and Wildlife Service. United States Geological Survey, Alaska Science Center, Anchorage.
- Stott PA. 2003. Attribution of regional-scale temperature changes to anthropogenic and natural causes. *Geophysical Research Letters* 30:10.10292003GLO17324.
- USFWS [United States Fish and Wildlife Service]. 2009. Species assessment and listing priority assignment form – Kittlitz's murrelet. Unpublished document. United States Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office, Alaska.
- USFWS. 2004. Species assessment and listing priority assignment form – Kittlitz's murrelet. Unpublished document. United States Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office, Alaska.
- van Pelt TI and JF Piatt. 2003. Population status of Kittlitz's and marbled murrelets and surveys for other marine bird and mammal species in the Kenai Fjords area, Alaska. Unpublished report. Alaska Science Center, United States Geological Survey, Anchorage.
- and -----. 2005. Population status of Kittlitz's murrelet along the southern coast of the Alaska Peninsula. United States Geological Survey Science Support Program. Draft report for United States Fish and Wildlife Service. United States Geological Survey, Alaska Science Center, Anchorage. 63 pp.
- van Vleet GB and M McAllister. 1994. Kittlitz's murrelet: The species most impacted by direct mortality from the Exxon Valdez oil spill? *Pacific Seabirds* 21: 5-6.
- Wynne K, D Hicks, and N Munro. 1991. 1990 salmon gillnet fisheries observer programs in Prince William Sound and south Unimak, Alaska. Report by Saltwater, Inc., Anchorage, Alaska. National Marine Fisheries Service, Juneau, Alaska.

- , -----, and -----. 1992. 1991 marine mammal observer program for the salmon driftnet fishery of Prince William Sound, Alaska. Final report. Saltwater, Inc., Anchorage, Alaska. National Marine Fisheries Service, Juneau, Alaska.
- Zwiefelhofer D. 2007. Comparison of bald eagle (*Haliaeetus leucocephalus*) nesting and productivity at Kodiak National Wildlife Refuge, Alaska, 1963-2002. Journal of Raptor Research 41: 1-9.